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Jefferson College of Health Professions

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Jefferson College of Health Professions
Research Council

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TABLE OF CONTENTS

Platform Presentations

Poster Presentations

Platform Presentations

Sterile Production as an Effective Teaching Tool

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Abstract:
Currently, most sterile products are sourced by large corporations, who charge a premium for essentially simple products. During the COVID pandemic, the few suppliers of Viral Transport Medium (VTM) for PCR testing were unable to meet global demand for this critical product, leading to shortages in the Jefferson Hospital network. The Biotechnology program was able to quickly obtain the necessary reagents, drafted a quality system to ensure sterile production, and began filling tubes. To keep up with the needs of Jefferson Hospitals, students needed to be trained on this process to allow for continuous production. Students were able to utilize this opportunity to fulfill practicum requirements while also performing a great civil service to the community. By the end of the effort, nearly 30,000 tubes were generated which saved Jefferson approximately $65,000 in costs over commercial supplies. Lessons from this effort led to the formation of the Biotech Production Laboratory, which is now partnering with suppliers to produce sterile saline products at reduced costs, while teaching students the value of training, SOP authoring, Quality Management Systems, sterile technique, and release of salable material. Students involved in these efforts have been heavily recruited into the biotech industry and are quickly becoming leaders due to their broad knowledge on the skills mastered during production runs. Providing students with real-world opportunities to create products makes them better prepared for future careers, and also can generate credit for upgrading the laboratories used to teach subsequent student cohorts.

[1]Faculty presenter: Sean G. Chadwick, M.S.

Medical Cannabis Telemedicine / Cannabis Technology

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M.S. Medical Cannabis, Science & Business

- Capstone

Abstract:
Currently, healthcare systems are experiencing a shortage of healthcare professionals which has led to a lack of access to healthcare professionals by patients. Telemedicine can help alleviate this issue by extending medical services to underserved or unserved areas. Remote consultations can also help resolve the challenges associated with healthcare delivery to different groups of patients, as information technology–based solutions such as telemedicine technology are the wave of the future. The unprecedented accessibility that patients have to mobile phones today, and the ubiquity of the cellular network, provide the potential to greatly alleviate the cost pressures in healthcare management. A medical cannabis telemedicine platform has the potential to address the access barrier issues facing medical cannabis patients and offer considerable value to rural patients who might not otherwise have access to licensed medical cannabis clinicians. By increasing access to medical cannabis it will help minimize the disparity of access among qualifying patients. Having this platform will also help better serve patients through 1) disease management; 2) reduction in both travel and time for patients and doctors; and 3) the provision of better healthcare standards in the medical cannabis community.

[1]Student presenter: Christina Dees, Alumna; Faculty Adviser: Brooke Worster, M.D., Assoc. Prof., SKMC; Faculty Adviser: Ruth Charbonneau, J.D., R.N., IEHP

Professional Responses to Animal Abuse in Childhood: A Mixed-Methods Exploration

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- Basic Research
- Permission from Primary Investigator if the project is part of a larger study: Permission granted by principal investigators Drs. Katharine Wenocur and Kirby Wycoff.

Abstract:
The link between abuse of animals and further acts of abuse, violence, and antisocial behavior is relatively well established. The goal of this study is to evaluate the knowledge and preparedness of professionals across several disciplines (veterinarians, mental health therapists, animal control officers, domestic violence advocates, legal professionals, and child welfare professionals) in responding to the knowledge that a minor (under the age of 18) has intentionally harmed a non-human animal, particularly as it relates to prevention and early intervention efforts for the child. This focus on interdisciplinary prevention efforts is predicated on the theory that all fields need to be considered and acting together when working to prevent animal abuse and other forms of future violence. The data collected during this study will benefit researchers and clinicians who seek to provide care to children who have harmed animals. The data collected will also assist researchers and policymakers in identifying areas to target for prevention and early intervention. A secondary goal of this study is to identify any gaps within current response efforts that may represent missed opportunities for prevention of further violence. This brief podium session will provide insights and information based on the early phases of this study as well as enabling a platform for interdisciplinary dialogue about the content and hypotheses of the study.

[1]Student presenter: Christine Eisenberg, M.S. student
[2]Student presenter: Ryan Gilchrist, M.S. student
[3]Faculty Advisers: Katharine Wenocur, D.S.W., L.C.S.W., RPT-S, C.A.A.P.T., Adjunct Prof., Kirby Wycoff, Psy.D., Ed.M., M.P.H., N.C.S.P., Assoc. Prof., Director, Doctor of Health Science Program

The Biotechnology "Shark Tank"

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Abstract:
Product Development and Management (BT325/525) is a novel course that develops student skills rarely covered in graduate or undergraduate programs. The cell & gene therapy industry in the Philadelphia area, coined "Cell-icon Valley", exhibits continued growth and consequently has created a great need for these companies to recruit graduates who can competently deliver within Quality Management Systems, while managing rapidly-evolving fast-moving projects utilizing new and emerging technologies. Students who can master these concepts will emerge as industry leaders at a time of a paradigm shift from traditional chemical engineering of compounds to biotech-inspired products such as CAR-T therapies, viral gene-delivery vectors, monoclonal antibody production, mRNA vaccines, and CRISPR gene editing. In this course, students generate their own novel biotechnology product concept and competitive business model. Students first present the product concept to the "Shark Tank" consisting of faculty and invited guests in the field. This product proposal will consist of concept descriptions, market research, SWOT analyses, and targeted funding sources. The "Sharks" will provide essential feedback to students, who will continue to evolve their product concept into a business model, which tracks the product lifecycle while building the necessary teams and skills to devise validation strategies and launch a successful product to the market. Students gain deep knowledge of cGLP, cGCP, cGMP, QC/QA and CAPA in accordance with ISO and FDA regulations as well as effective project management styles. Students once again face the "Shark Tank" and provide a detailed overview of their business model as their final course project.

[1]Faculty presenter: Scott E. Gygax, Ph.D.

Baculovirus: A Safe Viral Laboratory Learning Tool

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Abstract:
Philadelphia, the birthplace of the cell and gene therapy industry, and the surrounding region is predicted to become the next biopharma hub, causing a demand for biotechnology graduates who can competently and aseptically work in cell culture, specifically handling viral propagation, cultivation, and titration, while managing the growth of multiple cell lines. Students who can successfully master these viral vector biotechnological laboratory skills in clinical, agricultural, and basic research will emerge as industry leaders. However, safely teaching these biotech viral laboratory methods is a challenge in academia due to the biosafety level 2 pathogens commonly used in industry. To accommodate this, Cell and Tissue Culture (BT320/520) is a redesigned biotechnology lecture and laboratory course at Thomas Jefferson University that now develops student skills in viral propagation safely, without the need for biosafety level 2 conditions or higher, overcoming educational challenges. In this course, students use insect cells, to learn the biotechnological laboratory process of scaling up cell cultures to produce viral vectors. Students use the safe, biosafety level 1, BacMam 2.0 baculovirus technology, to master the process of producing and isolating large quantities of virus in insect cells, which is then used to transfect mammalian cells. Students encounter a variety of relevant methods including cell counting, sterility of cell medium, seeding and passaging cell cultures, contaminant diagnostics PCR, viral quantification using reporter gene, fluorescent microscopy, and more, providing a detailed overview of the entire viral production process from start to finish in one undergraduate or graduate semester.

[1]Faculty presenter: Paula C. McCourt, Ph.D.

Poster Presentations

Understanding the Role of mTORC1 and Integrated Stress Response in Mitochondrial Muscle Disease

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- Basic Research

Abstract:
Friedreich Ataxia (FRDA) is an autosomal recessive disorder caused by reduced levels of frataxin protein (FXN) due to an increased number of GAA repeats within the first intron of the FXN gene. The Seifert lab previous found that FXN depletion in mice, to model FRDA, leads to the activation of two stress response pathways in skeletal muscle and the heart, namely the mechanistic target of rapamycin complex 1 (mTORC1) and the Integrated Stress Response (ISR) pathways. Small molecule inhibitors for both pathways exist, so there is interest to determine if these inhibitors could be therapeutic strategies. These inhibitors are Rapamycin, which inhibits mTORC1, and Integrated Stress Response Inhibitor (ISRIB). The objective of this study is to determine if these inhibitors ameliorate pathological features that were described in the FRDA mouse model. To this end, we used exercise and behavioral tests, echocardiography (in collaboration with Yuexing Yuan, CTM), and western blotting to determine if FRDA mice treated with either inhibitor showed a milder phenotype. Because it is not known if the activation of mTORC1 or the ISR is adaptive or maladaptive in FRDA, using these inhibitors allowed us to also answer this basic question. We found a clear beneficial effect of Rapamycin on treadmill running; the FRDA mice no longer had a major deficit in running capacity and spent the same time running as the Control mice (also treated with Rapamycin). We hypothesize that the improvement reflects increased autophagic flux in skeletal muscle and will test this using an approach to slow down autophagic flux to be able to better detect it using by western blotting. Treatment with ISRIB did not appear to prevent the exercise defect, and also did not prevent poor Rota-Rod performance (a measure of neurological status) in FXN-depleted mice, however ISRIB appeared to worsen heart function. These preliminary data support a beneficial effect of Rapamycin and worsening effect of ISRIB in FRDA mice. This also suggests that mTORC1 activation in maladaptive in FXN-depleted skeletal muscle whereas ISR activation in FXN-depleted heart may be adaptive. (Funded by Friedreich's Ataxia Research Alliance, to ELS).

[1]Student presenter: Matthew Ignatius Dina, M.S. Biotechnology student
[2]Faculty Adviser: Erin L. Seifert, Ph.D., Asst. Prof., Dept. of Pathology & Genomic Medicine, SKMC

Quantitation of Radiation Exposure to Reproductive Organs from Common Radiographic Examinations

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- Applied Research

Abstract:
Radiography educational programs teach students to shield their patients when taking radiographic images. The purpose of shielding the gonadal region is to protect the reproductive organs from unnecessary radiation exposure. X-rays that include the pelvic region cannot employ shielding because it may obstruct the anatomy of interest. In this study, we used phantoms to compare the amount of radiation exposure to the reproductive organs with and without a lead shield. Phantoms, objects designed to resemble the density of a specific body part, were used to simulate patients being imaged. Phantoms were positioned for x-rays, and exposures were taken and measured with calibrated dosimeters placed at the pelvic region. Measurements of secondary (scatter and leakage) radiation were obtained for a variety of examinations with and without protective lead shields covering the dosimeters, with 3-5 exposures repeated for each situation. For a simulated anteroposterior knee x-ray, the secondary radiation to the pelvic region measured an average of 442 nGy without shielding and an average of 153 nGy with shielding. For an anteroposterior lumbar spine x-ray, the unshielded pelvic region received about 51 µGy. With shielding, the pelvic region received about 37 µGy. Although these results demonstrate that lead shields reduce radiation exposure to the gonadal region, it is also important to recognize that the exposure without a shield is extremely low and is statistically harmless. Improperly positioning the lead shield may result in the need for a repeat x-ray, increasing the patient's radiation exposure.

[1]Student presenter: Jasmine Lam, B.S. student
[2]Student presenter: Madalynne Ruth, B.S. student
[3]Faculty adviser: Eric Gingold, Ph.D., F.A.A.P.M., Assoc. Prof. Radiology, Director, Imaging Physics, SKMC

Elucidation of the hyphal growth defect in *Candida albicans ENT2* mutant

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- Basic Research

Abstract:
Research focused on finding the next-generation antifungal mechanism has led to the study of different Ent2 CRISPR knock-out strains of the yeast *Candida albicans.* Ent2 has been shown to play a role in filamentous growth under environmental conditions or stresses, as well as a virulence factor in systemic candidiasis. The *C. albicans* strain, KO-J17, has been identified to carry a rare Ent2 endocytosis defect that makes it incapable of producing hyphae and exhibits slow growth, a phenotype typically seen in petite mutants defective in oxidative phosphorylation. Nevertheless, studies have shown this mutation has also contributed to the gain of function resistance against the antifungal drug, fluconazole. The Thomas Jefferson Biotechnology (JBT) group has determined through experimentation that the slow growth phenotype of KO-J17 is not caused by a petite mutation since the cells have the ability to grow in non-fermentable carbon source media, such as glycerol. Further research by JBT has focused on analyzing the endocytosis defects of the *ENT2* mutant strain via rhodamine fluorescent actin staining to understand and characterize how an endocytosis mutation can lead to defects in hyphal growth and obtaining fluconazole resistance.

[1]Student presenter: Juanes Perez Rodriguez, B.S. student
[2]Student presenter: Victoria Triglia, M.S. student
[3]Faculty Adviser: Paula C. McCourt, Ph.D.

α-Amylase Concentration and Activity in the Maintenance of a Stable Vaginal Microflora

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- Basic Research

Abstract:
Bacterial vaginosis (BV) is the most common vaginal infection affecting more than 3 million women in the United States annually, with high rates of recurrence. BV infection can increase the likelihood of acquiring other sexually transmitted infections as well as causing health issues during pregnancies and transcervical procedures. In a healthy vaginal microenvironment, *lactobacilli* species (i.e. *L crispatus, L. jensenii,* and *L. gasseri)* are predominate. BV is caused by the sudden collapse of the healthy *lactobacilli* and the subsequent emergence of polymicrobial bacteria of obligate and facultative anaerobes. Recurrence and chronic BV occurs when the vagina is unable to regain a healthy vaginal microflora *lactobacilli* species. The enzyme α-amylase functions to cleave α 1-4 glycosidic bonds breaking down carbohydrate polymers into smaller glucose molecules. Humans express α-amylase in saliva, pancreatic secretion, and within the female vaginal tract. *Lactobacilli* require the carbohydrate monomers glucose and galactose to produce lactic acid. This presence of lactic acid gives the vagina an acidic pH, making it an unfavorable environment for foreign microbes. Here a linkage between low α-amylase concentration and activity in clinical patients who experience recurrent BV will be examined. It is hypothesized that in some women, recurrent BV may be due low α-amylase concentration and activity and thus fails to produce adequate carbohydrate monomers required by *Lactobacilli* for the optimum vaginal environment. This linkage will be studied by optimizing an α-amylase activity assay, sample shipping and storage conditions in preparation for comparing vaginal samples of recurrent BV and healthy controls.

[1]Student presenter: Nathan Slotnick, M.S. student
[2]Student presenter: Demitri Sukharev, B.S. student
[3]Faculty Adviser: Scott E. Gygax, Ph.D.

Elucidation of Fluconazole Resistance Mechanism in *Candida albicans* ENT2 Mutants

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- Basic Research

Abstract:

The rise of drug-resistant *Candida albicans* infections has become a significant challenge in clinical settings. Fluconazole, a commonly used anti-fungal drug, is facing increasing levels of resistance, resulting in treatment failures and patient morbidity. In order to investigate the mechanisms of resistance in the yeast strain *C. albicans*, RNA transcript analysis via qRT-PCR was performed to examine *ERG11*, *CDR1* and *MDR1* transcription levels in wild-type (WT), *ENT2* gene knockout (J17-KO), and knock-in (J17-1KI) strains. Minimum Inhibitory Concentration (MIC) assays are used to determine Fluconazole susceptibility in WT strains, which is successfully inhibited by fluconazole in comparison to J17-KO which shows resistance to fluconazole despite having increased susceptibility to amphotericin B. and caspofungin. By evaluating RNA transcripts in these strains and identifying changes in regulations of anti-fungal resistant genes (chosen based on the well-characterized genes found in *S. cerevisiae*), insight into possible drug targets for this hospital acquired infection may be gained. These ongoing experiments and research efforts may lead to better understand the mechanisms of fluconazole resistance in *C. albicans* and developing new therapeutic approaches to address clinical challenges.

[1]Student presenter: Fahmida Sumaiya, B.S. student
[2]Student presenter: Victoria Triglia, M.S. student
[3]Faculty Adviser: Sean G. Chadwick, M.S.